

1 1. A frequency selective surface (FSS) comprising a periodically
2 replicated unit cell,
3 the unit cell including a chemoresistive material having an electrical
4 conductivity that changes in a presence of an analyte.

1 2. The FSS of claim 1, wherein the unit cell further comprises an
2 arrangement of conducting patches on a dielectric substrate.

1 3. The FSS of claim 2, wherein at least two conducting patches are
2 interconnected by the chemoresistive material.

1 4. The FSS of claim 1, wherein the unit cell comprises a pattern of
2 chemoresistive material on a dielectric substrate.

1 5. The FSS of claim 1 wherein the unit cell includes at least one
2 dielectric slot in a conducting medium, the chemoresistive material being adjacent to
3 the dielectric slot.

1 6. The FSS of claim 1, wherein the chemoresistive material comprises a
2 conducting polymer.

1 7. The FSS of claim 1, wherein the electrical conductivity of the
2 conducting polymer decreases when the conducting polymer is exposed to the analyte.

1 8. The FSS of claim 1, wherein the chemoresistive material includes a
2 semiconductor nanostructure.

1 9. The FSS of claim 1, wherein the chemoresistive material includes a
2 metal nanostructure.

1 10. The FSS of claim 1, wherein the chemoresistive material includes a
2 composite of a polymer and electrically conducting particles.

1 11. The FSS of claim 10, wherein the conducting particles are carbon-
2 containing particles.

1 12. The FSS of claim 10, wherein the polymer swells on exposure to the
2 analyte.

1 13. An artificial magnetic conductor comprising the FSS of claim 1, the
2 FSS being supported by a surface of a thin dielectric substrate, the opposed surface of
3 the dielectric layer supporting an electrical conductor.

1 14. An electromagnetic absorber including the FSS of claim 1.

1 15. An antenna including the FSS of claim 1.

1 16. An electromagnetic reflector including the FSS of claim 1.

1 17. A process for detecting an analyte, the process comprising:
2 providing an apparatus including a chemoresistive material, the
3 chemoresistive material having an electrical conductivity that changes on exposure to
4 the analyte;
5 determining an electromagnetic property of the apparatus, the electromagnetic
6 property being correlated with the electrical conductivity of the chemoresistive
7 material; and
8 detecting the analyte using the electromagnetic property.

1 18. The process of claim 17, wherein the electromagnetic property is a
2 electromagnetic transmission, electromagnetic absorption, or electromagnetic
3 reflection.

1 19. The process of claim 17, wherein the apparatus has a resonance
2 frequency, and the electromagnetic property is determined at the resonance frequency.

1 20. The process of claim 17, wherein determining the electromagnetic
2 property includes irradiating the apparatus with electromagnetic radiation from a
3 remote source of electromagnetic radiation.

1 21. The process of claim 17, wherein the remote source of electromagnetic
2 radiation includes a radar transmitter.

1 22. The process of claim 17, wherein the apparatus includes a frequency
2 selective surface (FSS) comprising a periodically replicated unit cell, each unit cell
3 including the chemoresistive material.

1 23. The process of claim 22, wherein the FSS has a resonance frequency,
2 the electromagnetic property being detected at the resonance frequency.

1 24. The process of claim 17, wherein the apparatus is deployed into the
2 atmosphere, and determining the electromagnetic property of the apparatus includes
3 irradiating the apparatus with a radar beam and detecting reflected radar radiation.

1 25. A frequency selective surface (FSS), the FSS comprising a periodically
2 replicated unit cell, the unit cell including a chemoresistive material having an
3 electrical conductivity that changes in a presence of an analyte.

1 26. The FSS of claim 25, wherein the unit cell has a geometry chosen so as
2 to provide an electromagnetic resonance at a resonance frequency.

1 27. The FSS of claim 25, wherein the unit cell comprises an electrically
2 conducting patch and a region of chemoresistive material adjacent to the electrically
3 conducting patch.

1 28. The FSS of claim 25, wherein the unit cell comprises a plurality of
2 electrically conducting patches, and at least one region of chemoresistive material.

1 29. The FSS of claim 25, wherein the unit cell comprises a first
2 chemoresistive material having a first electrical conductivity correlated with a
3 presence of a first analyte, and a second chemoresistive material having an electrical
4 conductivity correlated with a presence of a second analyte.

1 30. The FSS of claim 25, wherein the unit cell includes at least one dipole
2 slot formed in a metal screen, and a region of chemoresistive material within the
3 metal screen.

1 31. The FSS of claim 30, wherein the region of chemoresistive material is
2 substantially adjacent to the at least one dipole slot.

1 32. An apparatus comprising a periodic structure,
2 the periodic structure including a pattern of chemoresistive material,
3 the apparatus having a first electromagnetic property in a presence of an
4 analyte, and a second electromagnetic property in an absence of the analyte,
5 a difference between the first electromagnetic property and the second
6 electromagnetic property at least in part arising from an electrical conductivity change
7 of the chemoresistive material.

1 33. The apparatus of claim 32, wherein the periodic structure is a
2 frequency selective surface supported on a surface of a dielectric layer.

1 34. The apparatus of 32, wherein the periodic structure further comprises a
2 replicated pattern of metal patches.

1 35. The apparatus of claim 32, wherein the apparatus is an electromagnetic
2 absorber, electromagnetic reflector, electromagnetic transmitter, or antenna.

1 36. An apparatus including a frequency selective surface (FSS),
2 the FSS comprising a pattern of conductive patches,

- 34 -

3 the conducting patches being selectively interconnectable by a matrix of
4 independently addressable switches.

1 37. The apparatus of claim 36, wherein the switches are passive switches
2 not in electrical communication with a voltage source.

1 38. The apparatus of claim 37, wherein the switches are responsive to an
2 external condition, the switches having a first electrical conductivity in a presence of
3 the external condition, and a second electrical conductivity in an absence of the
4 external condition.

1 39. The apparatus of claim 37, wherein the external condition is a presence
2 of an analyte, the switches having the first electrical conductivity in a presence of the
3 analyte, and the second electrical conductivity in an absence of the analyte.

1 40. The apparatus of claim 37, wherein the external condition is incident
2 electromagnetic radiation.

1 41. The apparatus of claim 36, comprising a plurality of switch types, each
2 switch type responsive to a different external condition.

1 42. The apparatus of claim 41, wherein each switch type is responsive to a
2 different analyte.

1 43. An apparatus substantially as described herein.

1 44. A process of detecting an external condition substantially as described
2 herein.